Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER III (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2733905 Date:03/05/2016

Subject Name: Solar Refrigeration and Air-conditioning

Time:10:30 am to 01:00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Use of solar energy and solar refrigeration data book is permitted after verification.**
3. **Make suitable assumptions wherever necessary.**

Q.1 **(a)** Explain in brief the design and performance of solar thermoelectric refrigerator proposed by Vella et al. in 1976. **07**

(b) An NH_3 vapour compression refrigerating machine produces 30 tons of ice from and at 0^0C in a day. The temperature range of working cycle is 25^0C to -15^0C. The vapour is dry and saturated at the end of compression. Assuming actual C.O.P. is 60% of theoretical C.O.P. Calculate H.P. required to drive compressor (Use theoretical approach only). Draw the cycle representing the problem. The properties of NH_3 are as follows : **07**

Temperature (^{0}C)	Liquid		Vapour	
	h_f (kcal/Kg)	s_f (kcal/ Kg $^-$K)	h_g (kcal/Kg)	s_g (kcal/ Kg -K)
25	23.91	0.083	315.3	1.072
-15	-13.04	-0.051	311.9	1.209

Q.2 **(a)** A cylindrical parabolic collector is used for heating a Thermic fluid. The concentrator has a following parameter : **09**

Aperture = 1.25 m, Length = 3.6 m,
Absorber tube : Inner diameter = 3.8 cm, Outer diameter = 4.2 cm
Concentric Glass cover : Inner diameter = 5.6 cm, Outer diameter = 6.3 cm
Overall loss coefficient = 13.27 W/m^2-K
Global radiation = 949 W/m^2, Beam radiation = 705 W/m^2
Absorbed flux = 483 W/m^2
Tilt factor for beam radiation = 1.014
Tilt factor for diffuse radiation = 0.993
Mass flow rate of Thermic fluid = 0.099 Kg/sec
Inlet fluid temperature = 150^0C, Ambient air temperature = 32^0C
Heat transfer coefficient = 193 W/m^2-K
The properties of Thermic fluid are : C_p= 2.449 kJ/Kg-K
Calculate (1) Concentration Ratio (2) Heat removal factor (3) Useful heat gain rate (4) instantaneous efficiency (5) Exit temperature of Thermic fluid (6) Mean Temperature of absorber plate.

(b) Write a short note on thermal chemical storage. **05**

OR

(b) Write a short note on latent heat storage. **05**

Q.3 **(a)** Derive an expression of collection efficiency factor and heat removal factor for flat plate collector. **08**

(b) Explain the selection criteria of refrigerant for solar operated vapour compression refrigeration system. **06**

OR

Q.3 **(a)** Derive an expression of heat removal factor for cylindrical parabolic collector. **07**

(b) Explain with neat sketch Gas compression cycle solar refrigeration system. **07**

Q.4	**(a)**	Explain the thermodynamic modeling of H_2O-LiBr vapour absorption refrigeration system.	**08**
	(b)	Discuss the comparative study of open cycle with closed cycle solar absorption refrigeration system.	**06**

OR

Q.4	**(a)**	Explain with neat sketch open cycle solar absorption refrigeration system.	**07**
	(b)	Explain with neat sketch solar operated absorption air-conditioning with refrigerant storage.	**07**
Q.5	**(a)**	Explain liquid desiccant solar cooling system using triethylene glyol with neat layout.	**07**
	(b)	Explain in brief solid desiccant open cycle solar cooling system.	**07**

OR

Q.5	**(a)**	Explain in brief working of a zolite-water closed adsorption solar cooling system with neat sketch.	**07**
	(b)	Define adsorption. Enlist the various (any four) liquid adsorbent. Discuss the desirable characteristics of liquid absorbents suitable for solar dehumidification.	**07**

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